

PART I

THE SECOND GENERATION CAPT MATHEMATICS EXAMINATION

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SUMMARY OF CHANGES FROM FIRST TO SECOND GENERATION

The changes being made in the Connecticut Academic Performance Test (CAPT) mathematics test between the first and second generations are essentially cosmetic, clarifying and in the area of reporting.

The CAPT mathematics test will continue to consist of open-ended and grid-in items. All items will continue to be contextually based. The eight open-ended items on each test will continue to require students to show their work and explain their reasoning. Any calculator will continue to be allowed for the entire test. The state will continue to release all of the open-ended items and half of the grid-in items each year.

However, the second generation test will:

- **be based on a clearer set of specifications;**
- **have six additional grid-in items;**
- **be consistently structured with eight items (two open-ended and six grid-in) for each of the four strands;**
- **provide a total mathematics score plus four strand scores; and**
- **allow students more time.**

More specifically:

1. As was done with the Connecticut Mastery Test, the CAPT specifications are now much more closely aligned with the state mathematics framework. Accordingly, test items will measure each of the 10 content standards from the framework and student achievement will be reported on the basis of:
 - total test;
 - number and quantity;
 - measurement and geometry;
 - statistics, probability and discrete mathematics; and
 - algebra and functions.
2. The first generation CAPT test included eight open-ended items in two contextually related clusters plus 18 grid-in items with no structured consistency of content from year to year. The second generation test will include eight open-ended items – two measuring each of the four strands – and 24 grid-in items – six measuring each of the four strands, for a total of 32 test items in two testing sessions.
3. Because of the additional grid-in items, the previous time allocation of 60 minutes for each session has been increased to 65 minutes for each session or 10 additional minutes in all for the two sessions that comprise the CAPT mathematics test.

SECOND GENERATION CAPT MATHEMATICS CONTENT SPECIFICATIONS

All CAPT mathematics items will be in a context and require students to **solve a problem**. In addition, all open-ended CAPT items will require students to show their work and explain their **reasoning**, thereby **communicating** their understanding of the relevant mathematics.

All CAPT items will be devised to measure one or more of the following aspects of mathematical content:

The Number and Quantity Strand

1. Number Sense
 - Use integers, fractions, decimals, percents and scientific notation in real-world situations to count, measure, compare, order, scale, locate and label.
 - Use a variety of representations (including graphs, tables, words, number lines, pictures, etc.) to present, interpret and communicate various kinds of numerical information.
 - Demonstrate an understanding of order, magnitude and equivalent forms of numbers.
2. Operations
 - Identify appropriate operations (including addition, subtraction, multiplication, division, exponentiation and square roots) and use these operations in a variety of contexts.
 - Select and use appropriate methods for computing (including mental mathematics, paper-and-pencil and calculator methods).
3. Estimation and Approximation
 - Select and use estimation strategies in problem situations.
 - Assess the reasonableness of answers to problems.
4. Ratios, Proportions and Percents
 - Use ratios, proportions and percents to solve problems.
 - Use dimensional analysis to determine equivalent rates (for example, converting inches-per-minute to feet-per-hour).
 - Use direct and inverse variation to solve numerical, geometric and algebraic problems.

The Measurement and Geometry Strand

5. Measurement
 - Use the concepts of length, perimeter, area, volume, angle measure, capacity, weight and mass to solve problems, using both metric and customary units.
 - Identify appropriate metric and customary measurement units and use appropriate measurement tools (including rulers and protractors).
 - Estimate, make and use measurements in realistic situations.
 - Use formulas and scales to determine measures.

6. Spatial Relationships and Geometry

- Interpret, describe and draw two- and three-dimensional objects.
- Use the concepts of rotation, reflection and translation to transform geometric figures.
- Describe and use fundamental concepts and properties of, and relationships among, points, lines, planes, angles and shapes (including incidence, parallelism, perpendicularity and the Pythagorean Theorem).
- Use the concepts of congruence and similarity to solve realistic problems.
- Use coordinate representations of geometric figures.
- Solve problems using geometric models.

The Statistics, Probability and Discrete Mathematics Strand

7. Probability and Statistics

- Demonstrate an understanding of sampling and its role in statistical assertions.
- Describe, calculate and apply the concepts of mean, median, mode and range.
- Construct, read and interpret tables, charts and graphs of real-world data.
- Make and evaluate inferences from tables, charts, graphs and other representations of data.
- Use probability to make predictions and evaluate the likelihood of simple and compound events.
- Use simulations to determine experimental probabilities.
- Compare experimental and theoretical probabilities and make predictions based on these probabilities.

10. Discrete Mathematics*

- Use systematic listing and counting strategies, including simple combinations and permutations, to solve problems.
- Use recursive processes, including iteration, to solve problems.

The Algebra and Functions Strand

8. Patterns

- Construct, describe, extend and analyze a variety of numerical, geometric and statistical patterns.
- Describe, analyze and generalize patterns using tables, rules, algebraic expressions and equations and graphs.
- Make and justify predictions based on patterns.

9. Algebra and Functions

- Represent and analyze situations involving variable quantities with tables, graphs, verbal rules and equations, and translate among representations.
- Use variables, expressions, equations and inequalities, including formulas, to model situations and solve problems.
- Construct and use linear functions to model and solve real-world situations.
- Use the coordinate plane to represent functions.

*The numbering used here is consistent with the Connecticut mathematics framework.

SCORING OPEN-ENDED CAPT ITEMS

CAPT open-ended tasks are scored holistically, using a four-point generic rubric and anchor papers. This section explains holistic scoring briefly and provides a description of the generic scoring rubric.

Four-point rubrics are being used with increased frequency in mathematics classrooms and are a common way to score student work on open-ended tasks similar to those used on the CAPT. The CAPT four-point rubric assigns scores of 3, 2, 1 or 0 to student work, based on the depth of understanding demonstrated.

One way to conceive of the rubrics is on the basis of a two-step decision-making process. First, decide whether the work is **acceptable** (3 or 2) or **unacceptable** (1 or 0). Second, decide whether the acceptable work is **full and complete**, although not necessarily perfect (3) or **reasonably satisfactory**, although flawed in a minor way (2), and whether the unacceptable work shows some **limited or partial** understanding (1) or such **minimal** understanding that only a score of 0 is appropriate. In many ways, the assignment of a holistic score to a sample of student work is like the familiar use of A (3), B (2), C (1) and D (0) grades to score compositions or essays.

It is critical that teachers understand that, while high levels of reliability and close adherence to anchor papers is critical for high-stakes tests like the CAPT or, for example, the essay questions found on AP examinations, no such demanding rigor is required for the effective use of holistic scoring in the classroom. All that is needed is a clear understanding and public statement of the general rubric and a consistent method of implementation. Under such conditions, it does not take long for students to calibrate themselves to the expectations being set.

In addition, some of the most powerful and positive professional discussions can take place when colleagues score student work on rich and engaging performance tasks and discuss in detail their agreements and disagreements. Only then can departmental colleagues calibrate their own expectations for student performance and increase the consistency with which holistic scoring is applied.

The released items and the scored and annotated samples of student work that are released following each administration of the CAPT are great places to start. Teachers should familiarize themselves with the score-point descriptions of the rubric, do the tasks themselves and then review and analyze the score and the annotation of each of the samples. These understandings then can be transferred to student work on any of the practice tasks in this handbook where, once again, teachers do the tasks themselves, score the student work, and discuss scoring agreements and disagreements among colleagues.

The CAPT generic four-point rubric appears on page 7. Remember that each score category contains a range of student responses which reflect the descriptions for the score point.

Score 3

The student has demonstrated a **full and complete** understanding of all concepts and processes embodied in this application. The student has addressed the task in a mathematically sound manner. The response contains evidence of the student's competence in problem solving and reasoning, computing and estimating, and communicating to the full extent that these processes apply to the specified task. The response may, however, contain minor arithmetic errors that do not detract from a demonstration of full understanding.

Score 2

The student has demonstrated a **reasonable** understanding of the essential mathematical concepts and processes embodied in this application. The student's response contains most of the attributes of an appropriate response, including a mathematically sound approach and evidence of competence with applicable mathematical processes, but contains flaws that do not diminish countervailing evidence that the student comprehends the essential mathematical ideas addressed by this task. Such flaws include errors ascribable to faulty reading, writing or drawing skills; errors ascribable to insufficient, non-mathematical knowledge; and errors ascribable to negligent or inattentive execution of mathematical ideas or algorithms.

Score 1

The student has demonstrated a **limited** understanding of some of the concepts and processes embodied in this application. The student's response contains some of the attributes of an appropriate response but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and other omissions or anomalies that bring into question the extent of the student's ability to solve problems of this general type.

Score 0

The student has demonstrated **merely an acquaintance** with the topic. The student's response is associated with the task in the item, but contains few attributes of an appropriate response. There are significant omissions or anomalies that indicate a basic lack of comprehension in regard to the mathematical ideas and procedures necessary to adequately address the specified task. No evidence is present to suggest that the student has the ability to solve problems of this general type.

CALCULATOR USE POLICY

In setting this policy governing the use of calculators on the CAPT, the State Department of Education was guided by the following facts and beliefs:

Facts:

- Some CAPT mathematics items are unreasonable to do without at least a four-function calculator.
- All CAPT items can be completed with a four-function calculator.
- The additional time students may gain if they use a graphics calculator is offset by the fact that the State Department of Education will provide enough time for all students – regardless of the calculator they use – to reasonably complete the test.

Beliefs:

- Fairness is not necessarily achieved when everyone uses the same calculator, but rather when students are allowed to use the calculator with which they are most familiar and comfortable.
- Students are most likely to do their best work when they use their own calculator, or one which the school has provided, and which students have used in instructional settings prior to the test.

Policy:

It is the policy of the State Department of Education, therefore, that students will be allowed to use any calculator provided to them or any calculator of their choosing, including scientific and graphics calculators, on the CAPT.

Additional Information:

In implementing this policy, schools and school districts should be aware of the following:

- All four current National Science Foundation-funded secondary mathematics curriculum development projects integrate the graphics calculator into daily instruction and assessment;
- The College Board's new policy for the SATs also provides that, in an effort to assure true calculator equity, students will be allowed to use the calculator with which they are most familiar and comfortable; and

Nothing in this policy should be used to discourage the purchase and use of graphics calculators for ongoing mathematics instruction, and eventually by all students on all tests.

THE CAPT MATHEMATICS STANDARD

In December 1994, a standard-setting panel comprised of mathematics teachers and supervisors, college and university mathematics educators, and business representatives was convened to review the CAPT mathematics test and student performance results for the purpose of setting a standard or “state goal” or “cut score”.

The panel was informed that this standard should be conceptualized as follows:

The standard for each subtest of the Connecticut Academic Performance Test represents a demanding level of achievement, reasonable to expect of students in the spring of their 10th grade. Students who score at this level possess the knowledge, skills and critical thinking abilities expected of Connecticut’s high school students as they prepare for the workplace and/or higher education. These students can apply what they know to complex problems and can effectively communicate their understanding.

On the first generation CAPT mathematics test this standard was approximately 28 out of 42 points. One way to picture this standard would involve a student averaging two out of the three possible points on each of the each eight open-ended items (16 points) and correctly answering two-thirds of the grid-in items (12 out of 18 for 12 points).

The standard for the second generation CAPT mathematics test has yet to be set, but is likely to be comparable to the standard used on the first generation.

